COURSE OF STUDIES
For
MASTER OF PHILOSOPHY (M. PHIL)
In
MLS HAEMATOTECHNOLOGY

UNIVERSITY OF HEALTH SCIENCES,

LAHORE

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CURRICULUM

M. PHIL MLS HAEMATOTECHNOLOGY

1. PROGRAM MISSION

UHS is one of the leading university of Pakistan. Department of Haematology is striving to produce highly competent Haematologists, Haematotechnologists and transfusion medicine specialists.

2. PROGRAM OBJECTIVES

Trainees will require the satisfactory completion of a structured training program in both Haematology as well as transfusion medicine. The objective of this training curriculum is to ensure a continuum in the acquisition of knowledge and skills in

- Red blood cell disorders
- White blood cell disorders
- Platelet and coagulation disorders
- Transfusion medicine

1. To enhance the basic understanding of the subject so that they can diagnose Hematological disorders.
2. To inculcate the utilization of new knowledge and technologies and their adoption according to local conditions.
3. To establish effective collaboration with other institutes and research centers for the benefit of the post-graduates to harness new technologies and increase their vision.
4. To enable the post-graduates to present their research findings effectively at National/International forums.
5. To pursue higher studies in any international university of high repute.

3. PROGRAM LEARNING OUTCOMES

At the end of the session, the students will be able to

- Understand the basic and up-to-date knowledge of blood and bone marrow disorders to investigate patients as an independent practitioner.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of hematological and non-hematological disorders. (Anaemias, Leukaemias, Lymphomas, lysosomal disorders, storage pool diseases, inherited and acquired bleeding disorders).

- Demonstrate the basic knowledge of transfusion medicine (blood group antigens, antibodies & diseases resulting from their interaction, blood group, HLA and platelet serology and its practical implications, blood and marrow donation, processing, storage & dispensing etc.).
- Illustrate the ability to perform all routine laboratory investigations and can interpret their results.
- Demonstrate the ability to perform all specialized and emergency hematological investigations and to organize and manage quality control in hematology and blood transfusion service.
- Understand the principles, and procedures of different methods and techniques (cytogenetics, molecular biology, immunology, nuclear medicine etc.) in diagnosing and managing hematological disorders.
- Apply and integrate the qualities of an effective teacher, team worker and leader.
- Summarize the knowledge and understanding of medical governance and audit.
- Develop the need for continuing professional development for the maintenance of standards of practice.
- Communicates effectively and can share decision-making, while maintaining appropriate situational awareness, professional behavior and professional judgment.
- Develop patient safety and effective quality improvement in patient care
- Produce well-trained specialists for Primary and Secondary Health care centers.
- Demonstrate the contribution of excellent research to society and the economy for the benefit of individuals, organizations and nations.
- Improve the university's fame and ranking at the National and international level with high-quality research work.
- To generate highly competent hematologists to qualify for higher studies at the international level

4. SCHEME OF STUDIES

4.1 Program duration

02 Year Program

4.2 Program type (Semester)

Semester System

4.3 Credit hours (Number and calculation)

Total numbers of credit hours	**30**
First Semester	**11 Credit hours**
Second Semester	**11 Credit hours**
Third & Fourth Semester	**08**

Note:

18 hours of face to face teaching will be equal to 01 credit hour

54 hours of clinical work/lab work/practical will be calculated as equal to 01 credit hour

SCHEME OF STUDIES M.PHIL HEMATOTECHNOLOGY (MLS)

Semester	Course Code	Course Title	Theory	Practical	Credit Hours
1st Semester	**MLS101**	English (communication skills)	01	0	1(1+0)
	MLS102	Research Methodology & Biostatistics	2	0	2(2+0)
	MLS103	Basic Laboratory Techniques	2	0	2(2+0)
	HEM701	Basic Laboratory Haematology and implementation of Quality assurance and quality control in Haematology Department	2	1	3(2+1)
	HEM702	Pathophysiology and Laboratory Diagnosis of Anaemias	1	1	2(1+1)
					Total =10
Semester	**Course Code**	**Course Title**	**Theory**	**Practical**	**Credit Hours**
2nd Semester	**MLS104**	Biosafety and Bioethics	2	0	2(2+0)
	MLS105	Laboratory Management	2	0	2(2+0)
	HEM703	Bone marrow failure syndrome and Laboratory investigations of malignant and nonmalignant white blood cell disorders	2	1	3(2+1)
	HEM704	Introduction to Haematostatic system and their lab investigation	2	1	3(2+1)
	HEM 705	Transfusion Medicine	1	1	2(1+1)
					Total =12
Semester 3 & 4	Research work and thesis			6	
	Research work and thesis And PTSA			02	

1. SYLLABUS

1.1 List of Courses

HEM701: Basic Laboratory Haematology and implementation of Quality assurance and quality control in Haematology Department

HEM702: Pathophysiology and Laboratory Diagnosis of Anaemias

HEM703: Bone marrow failure syndrome and Laboratory investigations of malignant and nonmalignant white blood cell disorders

HEM704: Introduction to Haematostatic system and their lab investigation

HEM705: Transfusion Medicine

1.2 Detail of courses

1.2.1 HEM701

1.2.1.1 Course title

Basic Laboratory Haematology and implementation of Quality assurance and quality control in Haematology Department

1.2.1.2 Course code

HEM701

1.2.1.3 Contact hours(Theory and Practical)

Face to face teaching	36
Clinical lab work	54

1.2.1.4 Credit Hours(Theory and Practical)

(2+1)

1.2.1.5 Course Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to:

- Define and Explain Quality Assurance Quality Control
- Explain and identify Pre-analytical, analytical and post analytical variables
- Define proficiency testing
- Identify and explain external quality control
- Discuss the importance of quality standards, models and awards (ISO, TQM, Malcolm Baldrige, EFQM etc.)

ASSESSMENT TOOLS

Clinical Skills:

Students will be able to

- Analyze and identify inventory management
- Explain the communication skills with lab staff, patients, administration and vendors
- Discuss the implementation of policies and SOPs
- Analyze optical techniques, electrochemistry, electrophoresis and Lab Automation including centrifuge, water bath, analytical balance, automated Hematology analyzers, spectrophotometer

Corse content:

Introduction to Haematology

- Review of vascular system and Blood constituents

Anatomy of Bone marrow and haematopoiesis

- Blood formation in the body (Intra-uterine and extra-uterine)

- Factors governing haematopoiesis
- Stages of normal cell maturation

Safe methods of securing blood for analysis

- Laboratory safety
- Safe handling of specimens
- Risk of communicable diseases such as HCV &HBV
- Exposure to reagents having toxic or carcinogenic nature

Quality control in Haematology and blood bank

- Internal quality control measures
- External quality assessment

Quality Assurance

- Pre-analytical, Analytical and Post-analytical Components

Estimation of Haemoglobin Concentration

Mannual methods

- Cyanmethaemoglobin (HiCN) method
- Preparation of Calibration curves
- Acid haematin and alkaline haematin method Oxyhaemoglobin method

Automated methods

- Other methods of haemoglobinometery

Enumeration of Erythrocytes (RBCs)

- General Principles of RBC count
- Methods for estimation
- The hemocytometer, red cell pipette and diluting fluids
- Normal Values in different age groups
- Automation of RBCs

Haematocrit

- Definition and principle of test procedures: Methods for estimation
- Correlation of hemoglobin, haematocrit, and erythrocyte count

Erythrocyte Sedimentation Rate

- Principle and kinds of test procedures
- Normal values
- Significance of abnormal Values

The Red Cell indices

- Mean Corpuscular Volume (MCV)
- Mean Corpuscular Haemoglobin (MCH)
- Mean Corpuscular Haemoglobin Concentration (MCHC)

Preparation of Blood Smears

- Preparation, drying & staining of smears
- Types of Stains & methods for preparation
- Criteria for good smear
- Variation in haemoglobin content and staining properties

Examination of stained smears

- Define differential count
- Observation of erythrocytes
- Number of Platelets estimated
- Tabulation of Leukocytes
- Classification of leukocytes and normal ranges

Reticulocyte Count

- Normal values for adults and infants

- Means of demonstrating reticulocytes, principle of the staining reaction
- Interpretation of findings & sources of error
- Preparation of stain
- Proficiency Testing
- Establishment of Quality Control Limits
- Interpretation of Quality Control Charts
- Bulls Testing Algorithm
- Monitoring QC with Patient Specimens
- Detection of abnormal Test Results And Delta Checks

Anticoagulants for Haematology tests

- Chemical anticoagulants
- Preparation and use of important anticoagulants
- Anticoagulation in blood banking

ASSESSMENT TOOL

- MCQs/SEQs

Suggested readings

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
3. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
4. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
5. De Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
6. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
7. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
8. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

2. HEM702

2.1.1.1 Course title

Pathophysiology and Laboratory Diagnosis of Anaemias

2.1.1.2 Course code

HEM702

2.1.1.3 Contact hours(Theory and Practical)

Face to face teaching 36

Clinical lab work 54

2.1.1.4 Credit Hours(Theory and Practical)

(2+1)

2.1.1.5 Course Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

- Demonstrate the basic knowledge of hematopoiesis
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of Iron Deficiency Anaemia and Megaloblastic anemia
- Demonstrate the etiology, pathophysiology, clinical features and laboratory investigations of iron metabolism disorder.
- Demonstrate the etiology, pathophysiology, clinical features and laboratory investigations of quantitative and qualitative hemoglobin disorder.
- Demonstrate the basic knowledge of Hemolytic anemias. Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of membrane and enzyme defects in hereditary hemolytic anaemia.

ASSESSMENT TOOL

MCQs/SEQs

CLINICAL SKILLS:

Students will

- Differentiate and analyze the test result of Microcytic anemias
- Identify and explain the test result of macrocytic anemia
- Describe and analyze different methods for assessing iron status
- Demonstrate Schilling test
- Identify and explain Perls stain
- Identify abnormalities of Red Cell, White Cell and Platelet in morphology, CBC analyzer report
- Apply and analyze the test result of normocytic anemia

- Identify and interpret reticulocyte count, osmotic fragility, G6PD assay, sickling, haemoglobin electrophoresis, HAMs, Kleihauer test

ASSESSMENT TOOL

OSPE/DOPS/TOACS/CBD

2.1.1.6 Course Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to understand the causes of anemias. The following components will be the part of basic semester:

Lab Diagnosis of Anaemias
- Introduction to anaemias
- Tests for Iron deficiency anaemia
- Tests for megaloblastic anaemia
- Tests for aplastic anaemia

Tests for hemolytic anaemia
- Congenital
- Acquired

Investigations for Membranopahties
- Introduction
- Osmotic fragility test
- Sucrose lysis test
- Ham's test

Investigations for Enzymopathies
- Glucose –6-Phosphate dehydrogenase deficiency
- Pyruvate Kinase Deficiency

Investigation of Abnormal Hemoglobins and Thalassaemia
- Hb Electrophoresis
- Estimation of Hb F
- Demonstration of Heinz Bodies
- Tests for Hb S
- Demonstration of Hb H
- Tests for Unstable Hb

2.1.1.7 Suggested readings

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
3. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
4. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
5. Robbins & Cotran Pathologic Basis of Disease 10th Edition by Vinay Kumar, Abul Abbas, Jon Aster10th Edition by Vinay Kumar, Abul Abbas, Jon Aster

6. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
7. Bone Marrow Pathology 5th Edition by Barbara J. Bain
8. de Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott

3. HEM703:

3.1.1.1 Course title

Bone marrow failure syndrome and Laboratory investigations of malignant and nonmalignant white blood cell disorders

3.1.1.2 Course code

HEM703

3.1.1.3 Contact hours(Theory and Practical)

Face to face teaching	36
Clinical lab work	54

3.1.1.4 Credit Hours(Theory and Practical)

(2+1)

3.1.1.5 Course Learning outcomes

KNOWLEDGE

1. Demonstrate adequate knowledge of the etiology, pathophysiology, clinical features and laboratory investigations of inherited BMF syndromes.
2. Identify and explain the etiology, pathophysiology, clinical features and laboratory investigations of acquired aplastic anemia and PNH.
3. Demonstrate the basic knowledge of Leucopoiesis
4. Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of malignant and nonmalignant white blood cell disorders.

Assessment Tool

MCQs/SEQs

CLINICAL SKILLS:

Following clinical skills are acquired after training on respective benches:

1. Carry out specified methods of bone marrow aspiration and trephine biopsy and do preliminary reporting.

a. Analyze and interpret cytochemical stains such as Sudan Black B, Myeloperoxidase, Periodic Acid Schiff, Alpha Naphthyl Acetate Esterase, Acid Phosphatase, Neutrophil Alkaline Phosphatase, Tartarate Resistant Acid Phosphatase and Iron stain

2. Illustrate and interpret immunohistochemical stains on the trephine biopsy sample
3. Identify and interpret immunophenotyping results of peripheral blood and bone marrow in hematological malignancies

Assessment Tool

OSPE/DOPS/CBD

3.1.1.6 Course content

The inherited BMF syndromes

- Pancytopenia (usually associated with a global haemopoietic defect)
- Fanconi anaemia, Clinical features, Cell and molecular biology
- Treatment
- Dyskeratosis congenital, Clinical features, Cell and molecular biology
- Treatment
- Shwachman–Diamond syndrome, Clinical features, Cell and molecular biology Treatment
- Acquired aplastic anaemia, Definition, Etiology and incidence, Pathogenesis and its clinical relevance
- Paroxysmal Nocturnal Hemoglobinuria, Etiology and Pathogenesis, Laboratory findings

Bone Marrow Aspiration

- Equipment required for the process
- Preparation of smears
- Processing & staining of bone marrow smears

Special stains in Haematology

- Sudan Black B
- MPO
- PAS
- Non-Specific Esterase
- Specific Esterase
- NAP Staining
- Acid Phosphatase
- Perl's stain

Bone Marrow Examination

Bone marrow Aspiration

- Procedure
- Staining of bone marrow smears
- Examination of Aspirated Bone Marrow smear
- Differential cell counts and Myelogram

Bone marrow Trephine biopsy

- Bone marrow trephine needles
- Preservation of biopsy

Immunophenotyping

- Instrumentation
- Sample Requirements
- Sample Processing
- Role in ALL, AML, CLL, Non-Hodgkin Lymphomas.

Introduction to Molecular Techniques

- BCR-ABL RT-PCR
- Southern Blot Analysis in Lymphoproliferative Disorders
- FISH

Tests for non-malignant diseases of white cells

- Tests for Infectious mononucleosis
- Monospot test
- Paul bunnel test

Acute Leukemia

Acute Lymphoblastic Leukemia

- Classification
- Lab Diagnosis

Acute Myeloid Leukemia

- Classification
- Lab Diagnosis

Myeloproliferative disorders

Chronic Myeloid Leukemia

- Introduction
- Lab Investigations
- Diagnostic Criteria
- Differentiation from Leukemoid Reaction

Polycythemia Vera

- Introduction
- Classification
- Lab Investigations
- Diagnostic Criteria

Essential Thrombocythemia

- Introduction
- Lab Investigations
- Diagnostic Criteria

Myelofibrosis

- Introduction
- Lab Investigations
- Diagnostic Criteria

Lymphoid Neoplasia

Chronic Lymphocytic Leukemia

- Introduction
- Lab Diagnosis
- Clinical Staging

Introduction to Hodgkin and Non-Hodgkin Lymphomas

- Classification
- Lab Diagnosis

Myelodysplastic syndromes

- Introduction
- Classification
- Lab Diagnosis

Plasma cell dyscrasias

- Introduction
- Multiple Myeloma & Lab Diagnosis
- Waldenstromes Macroglobulinemia
- Lab Diagnosis
- Light chain & heavy chain disease

3.1.1.7 Suggested readings

1. Bone Marrow Pathology 5th Edition by Barbara J. Bain
2. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
3. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
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9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
11. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

4. HEM704:

4.1.1.1 Course title

Introduction to Haematostatic system and their lab investigation

4.1.1.2 Course code

HEM704

4.1.1.3 Contact hours(Theory and Practical)

Face to face teaching	27
Clinical lab work	81

4.1.1.4 Credit Hours(Theory and Practical)

4(3+1)

4.1.1.5 Course Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

1. Demonstrate the basic knowledge of Megakaryopoiesis
2. Demonstrate knowledge about the etiology, pathophysiology, clinical features and laboratory investigations of:
    a. Hereditary Coagulation disorders
    b. Platelet disorders
    c. von Willebrand Disease
    d. Fibrinolytic Disorders
    e. Clotting Factors disorders and their Inhibitors
    f. Acquired Coagulation Disorders
    g. Coagulation defects in Liver and kidney disease
    h. Vitamin K deficiency
3. Illustrate the etiology, pathophysiology, diagnosis and management of arterial and venus Thrombosis (thrombophilia), Heparin-Induced Thrombocytopenia, Lupus Anticoagulants, Antiphospholipid Antibodies, and Antiphospholipid Syndrome
4. Able to interpret thrombophilia results in pregnancy, on the oral contraceptive pill, hormone replacement therapy and in patients on anticoagulant therapy
5. Apply important clinical concepts and principles to draw conclusions about Anticoagulant, Antiplatelet, and Thrombolytic Drugs

ASSESSMENT TOOL

MCQs/SEQs

CLINICAL SKILLS:

Students will:

1. Identify and explain the following laboratory tests
    a. Bleeding time
    b. Prothrombin time
    c. Activated Partial Thromboplastin Time
    d. Thrombin Time
    e. Fibrinogen level
    f. D dimers and Fibrinogen Degradation Products
    g. Mixing studies
    h. Factor assays
    i. Platelet function studies
    j. Urea lysis test
    k. Thrombophilia screening
    l. Lupus anticoagulant testing
    m. Factor V leiden assay
    n. Factor inhibitors
2. Use specified methods of enquiry and competence in taking sample collection and processing in Hemostasis
3. Demonstrate knowledge about the significance of taking history and an examination of a bleeding patient
4. Identify and explain the guidelines for Evaluation of Coagulation Analyzers and Coagulation Testing
5. Explain the Point-of-Care Testing in Hemostasis

ASSESSMENT TOOL

OSPE/DOPS/TOACS/CBD

4.1.1.6 Course contents

Platelets and Megakaryocytes

- Megakaryocytes
- Platelet formation and release
- Platelet structural and functional anatomy
- Platelet physiology
- Platelet function
    - Platelet adhesion

- Platelet aggregation
- Platelet release reaction
- Pathologic role of platelets in hemostasis and thrombosis
- Platelet antigens

Blood Coagulation and Fibrinolysis

- Normal coagulation cascade
- Clotting factors
  - Structure and function of all factors
- Natural inhibitors of coagulation system
  - Protein C and protein S pathway
  - Anticoagulant proteins
  - Alpha2 macrogloblin, serine protease inhibitors, Anti thrombin III,
  - Protein C inhibitor
  - Heparin Co factor II
  - Tissue factor pathway inhibitor
  - Fibrinolytic system
  - Inhibitors of fibrinolytic system
  - Physiologic regulation of fibrinolysis
- Role of fibrinolytic process in preventing thrombosis

Tests to evaluate the Haematostatic status

- Hess test
- Bleeding time by Duke's and Ivy's method
- Whole blood clotting time
- Prothrombin time (PT)
- Partial thrombolastin time (PTTK)
- Thrombin time
- Mixing studies
- Measurement of FDP & D-dimers
- Measurement of Fibrinogen
- Factor Assays

Bleeding Disorders Caused By Vascular Abnormalities

- Classification
- Pathophysiology
- Thrombocytopenia
- Classification
- Causes of thrombocytopenia
- Pathophysiology of immunological platelet destruction
- Thrombotic thrombocytopenic purpura
- Other forms of non-immunologic platelet destruction
- Thrombocytosis
- Qualitative Disorders Of Platelet Function
- Bernard Soulier syndrome
- Glanzmann's thrombasthenia
- Storage pool disease
- Abnormal platelet mechanism
- Acquired disorder of platelet function
- Inherited Coagulation Disorders
- Hemophilia A
- Von Willebrand's disease
- Hemophilia B
- Factor XIII deficiency
- Prothrombin deficiency
- Factor V deficiency
- Factor VII deficiency
- Factor X deficiency
- Factor XI and XII deficiency
- Pre kallikarein deficiency
- Acquired Coagulation Disorders
- Deficiency of vitamin k dependent factors
- Liver disease
- Disseminated intravascular coagulation
- Primary fibrinolysis
- Pathologic inhibitors of coagulation

- Thrombosis and Anti Thrombotic Drugs
- Pathophysiology of thrombosis
- Inherited thrombotic disorders
- Anti-thrombotic drugs
- Laboratory evaluation & monitoring of anticoagulant therapy

Platelet Function studies

- Aggregation patterns by ADP, Collagen, Adrenaline, Restocitin and Arachidonic acid

Thrombophilia

- Causes
- Lab Investigations

4.1.1.7 Suggested readings

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
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9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
11. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

5. HEM705:

5.1.1.1 Course title

Transfusion Medicine

5.1.1.2 Course code

HEM705

5.1.1.3 Contact hours(Theory and Practical)

Face to face teaching 18

5.1.1.4 Credit Hours(Theory and Practical)

(2+0)

5.1.1.5 Course Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

1. Illustrate the structure of immunoglobulin, genetic basis for antibody diversity, red cell alloantibodies and autoantibodies, Factors influencing antigen antibody reactions, Natural and acquired antibodies, Mechanisms of red cell sensitization, complement activation, blood product anticoagulants and preservatives.
2. Describe and explain the biochemistry, genetic inheritance, immunogenicity and clinical significance of Carbohydrate (ABO, Lewis, P, I/i) and Protein (Kell, Kidd, Duffy, MNS and others) red cell antigens
3. Identify and summarized the significance of disease associations with the null phenotypes of ABO, Rh and Kell
4. Identify and explain the types of blood donors and strategies to recruit voluntary blood donors
5. Analyze and explain the preparation and quality control of blood components
6. Demonstrate the indication, preparation and contraindication of Plateletpheresis, Leucapheresis/Plasmapheresis
7. Illustrate the complications of blood transfusion
8. Identify and explain the Hemolytic disease of the newborn
9. Identify and explain the indication & contraindication of component therapy in different disorders and special transfusion Circumstances such as pregnancy, neonates, transplant patients
10. Illustrate the Leukoreduction (indications and methods) and Emergency transfusion protocols

ASSESSMENT TOOLS

MCQs, SEQs

CLINICAL SKILLS:

Students will be able to

1. Identify serologic testing by different methods – Tube, gel, solid phase and microplates
2. Analyze the methods of Weak D testing, antibody screening and identification, cross matching, enhancement techniques, adsorption/elution techniques, Donath Landsteiner test and antibody titration tests
3. Identify and explain the investigation of blood transfusion reactions
4. Carry out the use of pediatric blood bags, sterile connecting devices, irradiation of red cell and platelet concentrates, leucodepleted blood products and leucocyte concentrate
5. Analyze the investigation of possible transfusion-transmitted infections
6. Monitor quality control of blood grouping, Coomb's antisera and blood products & Dispose of blood components
7. Use specified methods of Apheresis
8. Analyzing the serologic investigation of Immune hemolytic anemia

ASSESSMENT TOOL

OSPE/DOPS/CBD

5.1.1.6 Course contents

Requirement of a standard blood bank

- Area
- Staff
- Equipment
- Reagents

Donors

- Donor selection criteria
- Collection techniques
- Adverse reactions

Processing

- Labeling
- Storage of blood
- Screening for Transfusion transmitted disease

Storage

- Anticoagulants/preservatives
- Storage/refrigeration requirements
- Transportation
- Properties of stored products

Blood Components

- Red blood cells
- Fresh frozen plasma
- Cryoprecipitated AHF
- Platelets
- Plasma
- Leukocyte-reduced components
- Red blood cells deglycerolized
- Apheresis products

- Whole blood
- Washed red blood cells
- Gamma irradiated components
- Hematopoietic progenitors

Autologous Donors

Quality Assurance

- Blood samples
- Reagents
- Test procedures

Blood Group Systems

Genetics

- Basic
- Molecular
- Inheritance of blood groups

Chemistry, Antigens

- ABO
- Lewis
- Rh
- MNS
- P, Globoside
- Ii
- Kell
- Kidd
- Duffy
- Lutheran
- Other
- Antigens of high incidence
- Antigens of low incidence
- HLA
- Platelet specific
- Granulocyte specific

Immunology

Immunoglobulins

- Classes and subclasses
- Structure
- Biologic and physiochemical

Antigen-Antibody Interactions

- Principles
- Testing
- Principles
- Methods

Complement

- Classical and alternative pathway mechanisms
- Biologic properties

Serologic and Molecular Testing

Routine Tests

- Blood grouping tests
- Compatibility tests
- Antibody detection
- Crossmatch
- Antibody identification/clinical significance

- Antiglobulin testing
- Direct and indirect

Reagents

- Antiglobulin sera
- Blood grouping sera
- Reagent red cells

Application of Special Tests and Reagents

- Enzymes
- Enhancement media
- Lectins
- Adsorptions
- Elutions
- Titrations
- Solid phase
- Column agglutination test
- Microtechniques

Adverse Effects of Transfusion

- RBC/platelet destruction
- Physiology Detection (serologic, biochemical, clinical)
- Leukocyte/plasma protein reactions
- Non-immunologic reactions
- Disease transmission
- Graft vs. host disease

Investigations of Hemolytic Transfusion reactions

5.1.1.7 Suggested readings

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Modern Blood Banking & Transfusion Practices, 7th by Denise M. Harmening
3. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
4. AABB Technical Manual of Blood Banking 20th Edition
5. Basic & Applied Concepts of Blood Banking and Transfusion Practices, 5th Edition by Paula R. Howard, MS, MPH, MT(ASCP)SBB
6. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
7. Handbook of Haematology and Blood Transfusion Technique J.W. Delancy and G.Garralty
8. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp

Course Title: Professional & Teaching Skills Apprenticeship (PTSA)

Credit Hours:02

Professional Skills Apprenticeship credit hours: 01

Teaching Skills Apprenticeship credit hours (CMT): 01

Professional Skills Apprenticeship:

Learning outcomes

ASSESSMENT TOOLS

MCQs, SEQs

CLINICAL SKILLS:

Students will be able to

1. Identify and analyze laboratory findings of anemia
2. Identify and analyze laboratory findings of Leukemia, lymphomas and plasma cell dyscrasias
3. Identify and analyze coagulation disorders
4. Identify and analyze blood grouping & cross match
5. Identify and analyze peripheral smear morphology
6. Identify and analyze bone marrow aspiration morphology
7. Identify and analyze trephine biopsy morphology

ASSESSMENT TOOL

OSPE/DOPS/CBD

Course Outlines:

Hb estimation

Red cell count (automated & Manual)

White cell count (automated & Manual)

Platelet count (automated & Manual)

Iron studies

CBC analyzer

Iron stain

Reticulocyte stain

Hb electrophoresis

HPLC

SBB

MPO

PAS

Esterases (specific &non-specific)

Reticulin stain

Blood grouping

Cross match

Bone marrow aspiration & trephine

Teaching Skills Apprenticeship

All students of M Phil programme will get registered for the CMT Certification in the final semester. Completing the course work and successfully getting certified for CMT, which is a patent of UHS, will be a compulsory integral component of PTSA (Professional and Teaching Skills Apprenticeship) for the 4th semester of all M Phil programs at UHS.